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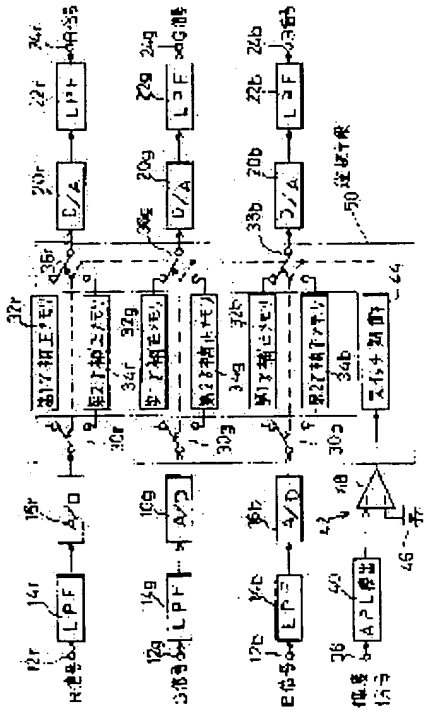
(54) GAMMA CORRECTION CIRCUIT FOR LIQUID CRYSTAL DISPLAY DEVICE

(57)Abstract:

PURPOSE: To improve the contrast of a display picture on a liquid crystal display device by implementing white level expansion and black level expansion corresponding respectively to a high APL and a low APL.

CONSTITUTION: In the gamma correction circuit in which gamma correction data are read out of a gamma correction memory based on a video signal (e.g. R, G, B signals) and the read data are used for display data to a liquid crystal display device, the gamma correction memory consists of 1st gamma correction memories 32r,... storing white level expansion and 2nd gamma correction memories 42r,... storing black level expansion, and an average level (APL) of a video signal (e.g. luminance signal) is detected by an APL detection circuit 40, a discrimination circuit 42 discriminates whether or not the detected level is larger than a set level and a selection means 50 selects either of the 1st gamma correction memories 32r,... or the 2nd gamma correction memories 34r,... based on the discrimination output.



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CLAIMS

[Claim(s)]
[Claim 1] The gamma correction circuit of the liquid crystal display which reads gamma correction data from gamma correction memory based on a video signal, and was made to make it into the indicative data to a liquid crystal display characterized by providing the following. It is the APL detector which forms the aforementioned gamma correction memory by the gamma correction memory of k (k is two or more integers) kind, and each of k kinds of this gamma correction memory comes to memorize the gamma correction data which elongated the intensity level of the individual range to which it corresponds when classifying into k individual ranges all the ranges of an intensity level that the aforementioned video signal can take, and detects the average level (APL) of the predetermined period of the aforementioned video signal. The judgment circuit which judges to any of the aforementioned individual range they are [range] k pieces the detection value of this APL detector belongs. A selection means to choose the gamma correction memory to which it corresponds of the k aforementioned kinds of gamma correction memory based on the decision output of this judgment circuit.
[Claim 2] The 1st gamma correction memory which memorized the gamma correction data for white-level extension for gamma correction memory, It forms by two kinds of gamma correction memory of the 2nd gamma correction memory which memorized the gamma correction data for black level extension. It is the gamma correction circuit of a liquid crystal display according to claim 1 where it comes to judge in whether a judgment circuit has the detection value of an APL detector larger than the value of a setting range, or it is small, and a selection means comes to choose one side of the above 1st and the 2nd gamma correction memory based on the decision output of the aforementioned judgment circuit.
[Claim 3] The gamma correction of the video signal is beforehand carried out by the transmitting side, and it becomes as a video signal. the gamma correction data of the 1st gamma correction memory A video signal uses the gamma correction of the aforementioned transmitting side as amendment gamma correction data proper to the following [the value of a setting range]. A video signal becomes as amendment gamma correction data excessively about the gamma correction of the aforementioned transmitting side to a larger thing than the value of a setting range. the gamma correction data of the 2nd gamma correction memory A video signal uses the gamma correction of the aforementioned transmitting side as amendment gamma correction data proper to the thing beyond the value of a setting range. The gamma correction circuit of a liquid crystal display according to claim 2 where a video signal consists the gamma correction of the aforementioned transmitting side of a value of a setting range as amendment gamma correction data excessively to a small thing.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention relates the signal for a display supplied to a liquid crystal display to improvement of an amendment gamma correction circuit so that the input-output behavioral characteristics (for example, voltage pair permeability property) of a liquid crystal display may serve as proportionality.
[0002]
[Description of the Prior Art] Generally, when a receiving side is a CRT (cathode-ray tube) display, the video signal outputted from a TV camera etc. by the transmitting side By carrying out a gamma correction in the comma amendment circuit which has a gamma correction property (for example, gamma=-2.2) as shown in (a) of drawing 4 The input-output behavioral characteristics (for example, gamma= 2.2) of the CRT of a receiving side itself as shown in (b) of this drawing were offset, and as shown in (c) of this drawing, the overall characteristic after amendment is amended so that input-output behavioral characteristics may serve as proportionality (gamma= 1). In (a) of drawing 4 , Ai expresses the input signal voltage corresponding to brightness (luminosity), and Ao expresses the output signal voltage of the comma amendment circuit of a transmitting side.
[0003] however, when a display is a liquid crystal display Since the input-output behavioral characteristics of this liquid crystal display itself are different from the input-output behavioral characteristics of a CRT display which became as shown in (c) of drawing 6 (for example, gamma is equivalent to about 3.5), and were shown in (b) of drawing 4 By conventionally forming the gamma correction circuit 10 as shown also in a receiving side at drawing 5 , the gamma correction as shown in (b) of drawing 6 was carried out, and as shown in (d) of this drawing, the overall characteristic after amendment was amended so that input-output behavioral characteristics might serve as proportionality (gamma= 1). In drawing 6 , in the input signal voltage to the gamma correction circuit 10, and Bo, the output signal voltage, and Ci and Di express input signal voltage, as for Bi, Co and Do express permeability, and Vm expresses the maximum of Bi.
[0004] R, G which the gamma correction circuit 10 carried out the color recovery of the video signal of an analog, and were obtained, Input terminal 12r for inputting the chrominance signal (it only being described as R, G, and B signal below) of B, 12g and 12b are provided. to each of these input terminals 12r, 12g, and 12b LPF 14r, 14g, and 14b, A/D (analog/digital) converter 16r, 16g, 16b, gamma correction memory (it is only described as gamma amendment memory below) 18r, It is constituted by combining 18g, 18b, the D/A (digital/analog) converters 20r, 20g, and 20b, LPF22r, 22g and 22b, and output terminals 24r, 24g, and 24b one by one.
[0005] gamma amendment memory 18r, 18g, and 18b was formed for example, in table (chart) form, and has memorized gamma correction data to which the gamma property that digital R, G, and B signal are shown in (b) of drawing 6 as a kind of address is satisfied. And R and G which were inputted into input terminals 12r, 12g, and 12b, and B signal LPF 14r, 14g, and 14b is minded. A/D converters 16r and 16g, It inputs into 16b and changes into digital R, G, and B signal. This digital R, The gamma

correction data which correspond from gamma amendment memory 18r, 18g, and 18b based on G and B signal are read. It displays by supplying R and G which changed into the signal of an analog by D/A converters 20r, 20g, and 20b, outputted to output terminals 24r, 24g, and 24b through LPF 22r, 22g, and 22b, and were outputted from these output terminals 24r, 24g, and 24b, and B signal to a liquid crystal display.

[0006]

[Problem(s) to be Solved by the Invention] however, in the conventional gamma correction circuit 10 shown in drawing 5 Even if it changes APL (ABAREJI PIKUCHUA level) which is the average level of the predetermined period (for example, 1 screen-display period of the 1 field) of a video signal to the one higher than a setting range and changes to the method of a low gamma amendment memory 18r and 18g and the gamma correction data in 18b do not change, but since the gamma property is fixed The adjustable range of the intensity level of a video signal became narrow at the case where APL is higher than a setting range, or the low case, and since the alignment drive range of a liquid crystal display was narrow, there was a trouble that the contrast of the display image of a liquid crystal display became low.

[0007] this invention elongates an intensity level by making large the adjustable range of the intensity level of a video signal in the changed range, even if it was made in view of the above-mentioned trouble and changes APL of a video signal to the higher one or the method of a low, and aims at offering the gamma correction circuit of the liquid crystal display which can improve contrast of the display image of a liquid crystal display.

[0008]

[Means for Solving the Problem] In the gamma correction circuit of the liquid crystal display which this invention reads gamma correction data from gamma amendment memory based on a video signal, and was made to make it into the indicative data to a liquid crystal display The aforementioned gamma amendment memory is formed by gamma amendment memory of k (k is two or more integers) kind. each of k kinds of this gamma amendment memory It comes to memorize the gamma correction data which elongated the intensity level of the individual range to which it corresponds when classifying into k individual ranges all the ranges of an intensity level that the aforementioned video signal can take. The APL detector which detects the average level (APL) of the predetermined period of the aforementioned video signal, The detection value of this APL detector possesses the judgment circuit which judges to any of the aforementioned individual range whose number is k it belongs, and a selection means to choose gamma amendment memory to which it corresponds of the k aforementioned kinds of gamma amendment memory based on the decision output of this judgment circuit, and is characterized by the bird clapper.

[0009]

[Function] An APL detector detects APL which is the average level of the predetermined period (for example, 1 screen-display period of the 1 field) of a video signal, and a selection means chooses gamma amendment memory (for example, k-th gamma amendment memory which elongated the high intensity level) corresponding to the individual range (for example, individual range which is the k-th with a high intensity level) to which a detection value belongs. And since the gamma correction data which elongated the intensity level (for example, white level) which corresponds based on a video signal from gamma amendment memory (for example, k-th gamma amendment memory) are read and it considers as the indicative data to a liquid crystal display, even if it changes APL, in the changed range, the adjustable range of the intensity level of a video signal becomes large.

[0010]

[Example] Hereafter, one example of the gamma correction circuit of the liquid crystal display by this invention is explained using drawing 1 - drawing 3 . Let the same portion as drawing 4 - drawing 6 be the same sign in drawing 1 - drawing 3 . In drawing 1 , 12r, 12g, and 12b are the input terminals for inputting the chrominance signal (it only being described as R, G, and B signal below) of R, G, and B which carried out the color recovery and obtained the video signal of an analog. LPF 14r, 14g, and 14b and the A/D (analog/digital) converters 16r, 16g, and 16b combined with each of the aforementioned input terminals 12r, 12g, and 12b one by one, and the common terminal of one change-over switches

30r, 30g, and 30b has combined with the output side of aforementioned A/D converters 16r, 16g, and 16b.

[0011] For each two individual terminal of the aforementioned change-over switches 30r, 30g, and 30b 1st gamma correction memory (it is only described as 1stgamma amendment memory below) 32r for white-level extension, 32g, 32b, and 2nd gamma correction memory (it is only described as 2ndgamma amendment memory below) 34r for black level extension, The input side of 34g and 34b joins together. The aforementioned 1stgamma amendment memory 32r and 32g, One individual terminal of the change-over switches 36r, 36g, and 36b of another side combines with the output side of 32b. To the output side of the aforementioned 2ndgamma amendment memory 34r, 34g, and 34b, aforementioned change-over-switch 36r, The individual terminal of another side of 36g and 36b joined together, and D/A converters 20r, 20g, and 20b, LPF22r, 22g and 22b, and output terminals 24r, 24g, and 24b have combined with the common terminal of the aforementioned change-over switches 36r, 36g, and 36b one by one.

[0012] Gamma correction data which are satisfied [with the aforementioned 1stgamma amendment memory 32r, 32g, and 32b] of the gamma correction property shown in (b) of drawing 2 are memorized beforehand. The input signal voltage Bi becomes the same as that of the conventional gamma correction property shown in (b) of drawing 6 in 0-Vm/2, the proportionality of gamma= 1 is materialized by the input signal voltage Bi in the range of Vm/2-Vm, and the gamma correction property shown in (b) of this drawing 2 is constituted.

[0013] Gamma correction data which are satisfied [with the aforementioned 2ndgamma amendment memory 34r, 34g, and 34b] of the gamma correction property shown in (b) of drawing 3 are memorized beforehand. The gamma correction property shown in (b) of this drawing 3 is constituted so that the proportionality of gamma= 1 may be materialized in 0-Vm/2, the input signal voltage Bi may become the same as that of the conventional gamma correction property which the input signal voltage Bi shows to (b) of drawing 6 in the range of Vm/2-Vm and the overall characteristic after amendment may serve as black level extension.

[0014] 38 is a luminance-signal input terminal and the APL detector 40 which detects APL which is the average level of the predetermined period (for example, 1 screen-display period of the 1 field) of a luminance signal has combined it with this luminance-signal input terminal 38. The switch control circuit 44 has combined with the output side of the aforementioned APL detector 40 through the judgment circuit 42. The aforementioned judgment circuit 42 is constituted by the subject in the comparator 48 in comparison with the reference voltage which set up APL by the reference supply 46, and the aforementioned switch control circuit 44 is constituted so that the movable piece of the aforementioned change-over switches 30r, 30g, 30b, 36r, 36g, and 36b may be switched and controlled.

[0015] The aforementioned switch control circuit 44, change-over switches 30r, 30g, and 30b, and 36r, 36g and 36b constitute the selection means 50. This selection means 50 is not restricted to above-mentioned composition, when the decision output of the judgment circuit 42 is [for example,] H, it enables the 1stgamma amendment memory 32r, 32g, and 32b, and the 2ndgamma amendment memory 34r, 34g, and 34b is enabled at the time of L, and it may be made to change it into the state where each can be written.

[0016] Below, an operation of the aforementioned example is explained.

(b) The APL detector 40 detects APL which is the average level of the predetermined period (for example, 1 screen-display period of the 1 field) of the luminance signal of the analog video signals, and the judgment circuit 42 judges whether APL of a detection value is larger than the set point or small.

[0017] (b) Although it corresponds when the average luminance of the screen in 1 screen-display period is larger than the set point, and is whitish and APL is larger than the set point At this time, the output of a comparator 48 serves as H level. the switch control circuit 44 Change-over switches 30r, 30g, and 30b and the movable piece of 36r, 36g, and 36b are connected to the 1stgamma amendment memory 32r and 32g and the individual terminal by the side of 32b, and the 1stgamma amendment memory 32r, 32g, and 32b is chosen as gamma amendment memory.

[0018] For this reason, the gamma correction property of the gamma correction circuit of a receiving side turns into a property which elongated the white level, as shown in (b) of drawing 2 . Namely, by the

input signal voltage Bi corresponding to R of the analog video signals, G, and B signal becoming the same [a gamma correction property] as that of the conventional example in 0-Vm / 2 (the low range of a luminosity), as shown in the left-hand side of (d) of drawing 2 , although the proportionality of gamma= 1 is materialized, the overall characteristic after amendment As the input signal voltage Bi shows the right-hand side of (d) of drawing 2 in the range (range with a high luminosity) of Vm/2-Vm, rather than the case of the proportionality of gamma= 1 shown by the dotted line, the adjustable range of an output (permeability) becomes large, and a white level develops.

[0019] (c) Although it corresponds when the average luminance of the screen in 1 screen-display period is smaller than the set point, and is blackish and APL is smaller than the set point At this time, the output of a comparator 48 serves as L level. the switch control circuit 44 Change-over switches 30r, 30g, and 30b and the movable piece of 36r, 36g, and 36b are connected to the 2ndgamma amendment memory 34r and 34g and the individual terminal by the side of 34b, and the 2ndgamma amendment memory 34r, 34g, and 34b is chosen as gamma amendment memory.

[0020] For this reason, the gamma correction property of the gamma correction circuit of a receiving side turns into a property which elongated black level, as shown in (b) of drawing 3 . The input signal voltage Bi corresponding to R of the analog video signals, G, and B signal namely, in 0-Vm / 2 (the low range of brightness) As shown in the left-hand side of (d) of drawing 3 , rather than the case of the proportionality of gamma= 1 shown by the dotted line, the adjustable range of an output (permeability) becomes large, and black level develops. In the range (range with high brightness) of Vm/2-Vm, the input signal voltage Bi becomes the same [a gamma correction property] as that of the conventional example, as shown in the right-hand side of (d) of drawing 3 , and as for the overall characteristic after amendment, the proportionality of gamma= 1 is materialized.

[0021] Although formed in the aforementioned example by the 1stgamma amendment memory which memorized the gamma correction data for white-level extension for gamma amendment memory, and two kinds of gamma amendment memory of the 2ndgamma amendment memory which memorized the gamma correction data for black level extension this invention is not restricted to this and forms gamma amendment memory by three or more kinds of gamma amendment memory. each of such gamma amendment memory The gamma correction data which elongated the intensity level of the individual range to which it corresponds when classifying into the individual range of the number of memory kinds all the ranges of an intensity level that a video signal can take are memorized, and you may make it become.

[0022] Although a video signal is made into the input signal of the video signal which carried out the gamma correction to CRT displays beforehand by the transmitting side and gamma correction data were read from gamma amendment memory in the aforementioned example based on this received video signal, this invention cannot be restricted to this, can make an input signal the video signal which has not carried out a gamma correction by the transmitting side, and can use it also about what read gamma correction data from gamma amendment memory based on this received video signal.

[0023] although the aforementioned example explained the case where this invention was used for the gamma correction circuit of the liquid crystal display for color displays, this invention is not restricted to this and it can use also about the gamma correction circuit of the liquid crystal display for a monochrome display -- it is natural

[0024]

[Effect of the Invention] The gamma correction circuit of the liquid crystal display by this invention As mentioned above, form gamma amendment memory by k kinds of gamma amendment memory, and the gamma correction data which elongated the intensity level of the individual range corresponding to each of this kind of gamma amendment memory are memorized. Detect APL of a video signal and gamma amendment memory (for example, k-th gamma amendment memory which elongated the high intensity level) corresponding to the individual range (for example, individual range which is the k-th with a high intensity level) to which the detection value belongs is chosen. Since it constituted so that the gamma correction data which elongated the intensity level (for example, white level) which corresponds from gamma amendment memory (for example, k-th gamma amendment memory) chosen based on the video

signal might be read and it might consider as the indicative data to a liquid crystal display, even if it changes APL In the changed range, the adjustable range of the intensity level of a video signal can be made large. For this reason, when a display image is bright, a white level is elongated, when dark, black level can be elongated and contrast can be improved.

[Translation done.]

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TECHNICAL FIELD

[Industrial Application] this invention relates the signal for a display supplied to a liquid crystal display to improvement of an amendment gamma correction circuit so that the input-output behavioral characteristics (for example, voltage pair permeability property) of a liquid crystal display may serve as proportionality.

[Translation done.]

* NOTICES *

PRIOR ART

[Description of the Prior Art] Generally, when a receiving side is a CRT (cathode-ray tube) display, the video signal outputted from a TV camera etc. by the transmitting side By carrying out a gamma correction in the comma amendment circuit which has a gamma correction property (for example, gamma=-2.2) as shown in (a) of drawing 4 The input-output behavioral characteristics (for example, gamma= 2.2) of the CRT of a receiving side itself as shown in (b) of this drawing were offset, and as shown in (c) of this drawing, the overall characteristic after amendment is amended so that input-output behavioral characteristics may serve as proportionality (gamma= 1). In (a) of drawing 4 , Ai expresses the input signal voltage corresponding to brightness (luminosity), and Ao expresses the output signal voltage of the comma amendment circuit of a transmitting side.
[0003] however, when a display is a liquid crystal display Since the input-output behavioral characteristics of this liquid crystal display itself are different from the input-output behavioral characteristics of a CRT display which became as shown in (c) of drawing 6 (for example, gamma is equivalent to about 3.5), and were shown in (b) of drawing 4 By conventionally forming the gamma correction circuit 10 as shown also in a receiving side at drawing 5 , the gamma correction as shown in (b) of drawing 6 was carried out, and as shown in (d) of this drawing, the overall characteristic after amendment was amended so that input-output behavioral characteristics might serve as proportionality (gamma= 1). In drawing 6 , in the input signal voltage to the gamma correction circuit 10, and Bo, the output signal voltage, and Ci and Di express input signal voltage, as for Bi, Co and Do express permeability, and Vm expresses the maximum of Bi.
[0004] R, G which the gamma correction circuit 10 carried out the color recovery of the video signal of an analog, and were obtained, Input terminal 12r for inputting the chrominance signal (it only being described as R, G, and B signal below) of B, 12g and 12b are provided. to each of these input terminals 12r, 12g, and 12b LPF 14r, 14g, and 14b, A/D (analog/digital) converter 16r, 16g, 16b, gamma correction memory (it is only described as gamma amendment memory below) 18r, It is constituted by combining 18g, 18b, the D/A (digital/analog) converters 20r, 20g, and 20b, LPF22r, 22g and 22b, and output terminals 24r, 24g, and 24b one by one.
[0005] gamma amendment memory 18r, 18g, and 18b was formed for example, in table (chart) form, and has memorized gamma correction data to which the gamma property that digital R, G, and B signal are shown in (b) of drawing 6 as a kind of address is satisfied. And R and G which were inputted into input terminals 12r, 12g, and 12b, and B signal LPF 14r, 14g, and 14b is minded. A/D converters 16r and 16g, It inputs into 16b and changes into digital R, G, and B signal. This digital R, The gamma correction data which correspond from gamma amendment memory 18r, 18g, and 18b based on G and B signal are read. It displays by supplying R and G which changed into the signal of an analog by D/A converters 20r, 20g, and 20b, outputted to output terminals 24r, 24g, and 24b through LPF 22r, 22g, and 22b, and were outputted from these output terminals 24r, 24g, and 24b, and B signal to a liquid crystal display.

[Translation done.]

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EFFECT OF THE INVENTION

[Effect of the Invention] The gamma correction circuit of the liquid crystal display by this invention, As mentioned above, form gamma amendment memory by k kinds of gamma amendment memory, and the gamma correction data which elongated the intensity level of the individual range corresponding to each of this kind of gamma amendment memory are memorized. Detect APL of a video signal and gamma amendment memory (for example, k-th gamma amendment memory which elongated the high intensity level) corresponding to the individual range (for example, individual range which is the k-th with a high intensity level) to which the detection value belongs is chosen. Since it constituted so that the gamma correction data which elongated the intensity level (for example, white level) which corresponds from gamma amendment memory (for example, k-th gamma amendment memory) chosen based on the video signal might be read and it might consider as the indicative data to a liquid crystal display, even if it changes APL In the changed range, the adjustable range of the intensity level of a video signal can be made large. For this reason, when a display image is bright, a white level is elongated, when dark, black level can be elongated and contrast can be improved.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] however, in the conventional gamma correction circuit 10 shown in drawing 5 Even if it changes APL (ABAREJI PIKUCHUA level) which is the average level of the predetermined period (for example, 1 screen-display period of the 1 field) of a video signal to the one higher than a setting range and changes to the method of a low gamma amendment memory 18r and 18g and the gamma correction data in 18b do not change, but since the gamma property is fixed The adjustable range of the intensity level of a video signal became narrow at the case where APL is higher than a setting range, or the low case, and since the alignment drive range of a liquid crystal display was narrow, there was a trouble that the contrast of the display image of a liquid crystal display became low. [0007] this invention elongates an intensity level by making large the adjustable range of the intensity level of a video signal in the changed range, even if it was made in view of the above-mentioned trouble and changes APL of a video signal to the higher one or the method of a low, and aims at offering the gamma correction circuit of the liquid crystal display which can improve contrast of the display image of a liquid crystal display.

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MEANS

[Means for Solving the Problem] this invention is characterized by the gamma correction circuit of the liquid crystal display which reads gamma correction data from gamma amendment memory based on a video signal, and was made to make it into the indicative data to a liquid crystal display possessing the following. It is the APL detector which forms the aforementioned gamma amendment memory by gamma amendment memory of k (k is two or more integers) kind, and each of k kinds of this gamma amendment memory comes to memorize the gamma correction data which elongated the intensity level of the individual range to which it corresponds when classifying into k individual ranges all the ranges of an intensity level that the aforementioned video signal can take, and detects the average level (APL) of the predetermined period of the aforementioned video signal. The judgment circuit which judges to any of the aforementioned individual range they are [range] k pieces the detection value of this APL detector belongs. A selection means to choose gamma amendment memory to which it corresponds of the k aforementioned kinds of gamma amendment memory based on the decision output of this judgment circuit.

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OPERATION

[Function] An APL detector detects APL which is the average level of the predetermined period (for example, 1 screen-display period of the 1 field) of a video signal, and a selection means chooses gamma amendment memory (for example, k-th gamma amendment memory which elongated the high intensity level) corresponding to the individual range (for example, individual range which is the k-th with a high intensity level) to which a detection value belongs. And since the gamma correction data which elongated the intensity level (for example, white level) which corresponds based on a video signal from gamma amendment memory (for example, k-th gamma amendment memory) are read and it considers as the indicative data to a liquid crystal display, even if it changes APL, in the changed range, the adjustable range of the intensity level of a video signal becomes large.

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EXAMPLE

[Example] Hereafter, one example of the gamma correction circuit of the liquid crystal display by this invention is explained using drawing 1 - drawing 3 . Let the same portion as drawing 4 - drawing 6 be the same sign in drawing 1 - drawing 3 . In drawing 1 , 12r, 12g, and 12b are the input terminals for inputting the chrominance signal (it only being described as R, G, and B signal below) of R, G, and B which carried out the color recovery and obtained the video signal of an analog. LPF 14r, 14g, and 14b and the A/D (analog/digital) converters 16r, 16g, and 16b combined with each of the aforementioned input terminals 12r, 12g, and 12b one by one, and the common terminal of one change-over switches 30r, 30g, and 30b has combined with the output side of aforementioned A/D converters 16r, 16g, and 16b.
[0011] For each two individual terminal of the aforementioned change-over switches 30r, 30g, and 30b 1st gamma correction memory (it is only described as 1stgamma amendment memory below) 32r for white-level extension, 32g, 32b, and 2nd gamma correction memory (it is only described as 2ndgamma amendment memory below) 34r for black level extension, The input side of 34g and 34b joins together. The aforementioned 1stgamma amendment memory 32r and 32g, One individual terminal of the change-over switches 36r, 36g, and 36b of another side combines with the output side of 32b. To the output side of the aforementioned 2ndgamma amendment memory 34r, 34g, and 34b, aforementioned change-over-switch 36r, The individual terminal of another side of 36g and 36b joined together, and D/A converters 20r, 20g, and 20b, LPF22r, 22g and 22b, and output terminals 24r, 24g, and 24b have combined with the common terminal of the aforementioned change-over switches 36r, 36g, and 36b one by one.
[0012] Gamma correction data which are satisfied [with the aforementioned 1stgamma amendment memory 32r, 32g, and 32b] of the gamma correction property shown in (b) of drawing 2 are memorized beforehand. The input signal voltage Bi becomes the same as that of the conventional gamma correction property shown in (b) of drawing 6 in 0-Vm/2, the proportionality of gamma= 1 is materialized by the input signal voltage Bi in the range of Vm/2-Vm, and the gamma correction property shown in (b) of this drawing 2 is constituted.
[0013] Gamma correction data which are satisfied [with the aforementioned 2ndgamma amendment memory 34r, 34g, and 34b] of the gamma correction property shown in (b) of drawing 3 are memorized beforehand. The gamma correction property shown in (b) of this drawing 3 is constituted so that the proportionality of gamma= 1 may be materialized in 0-Vm/2, the input signal voltage Bi may become the same as that of the conventional gamma correction property which the input signal voltage Bi shows to (b) of drawing 6 in the range of Vm/2-Vm and the overall characteristic after amendment may serve as black level extension.
[0014] 38 is a luminance-signal input terminal and the APL detector 40 which detects APL which is the average level of the predetermined period (for example, 1 screen-display period of the 1 field) of a luminance signal has combined it with this luminance-signal input terminal 38. The switch control circuit 44 has combined with the output side of the aforementioned APL detector 40 through the judgment circuit 42. The aforementioned judgment circuit 42 is constituted by the subject in the comparator 48 in comparison with the reference voltage which set up APL by the reference supply 46,

and the aforementioned switch control circuit 44 is constituted so that the movable piece of the aforementioned change-over switches 30r, 30g, 30b, 36r, 36g, and 36b may be switched and controlled.
[0015] The aforementioned switch control circuit 44, change-over switches 30r, 30g, and 30b, and 36r, 36g and 36b constitute the selection means 50. This selection means 50 is not restricted to above-mentioned composition, when the decision output of the judgment circuit 42 is [for example,] H, it enables the 1stgamma amendment memory 32r, 32g, and 32b, and the 2ndgamma amendment memory 34r, 34g, and 34b is enabled at the time of L, and it may be made to change it into the state where each can be written.
[0016] Below, an operation of the aforementioned example is explained.
(b) The APL detector 40 detects APL which is the average level of the predetermined period (for example, 1 screen-display period of the 1 field) of the luminance signal of the analog video signals, and the judgment circuit 42 judges whether APL of a detection value is larger than the set point or small.
[0017] (b) Although it corresponds when the average luminance of the screen in 1 screen-display period is larger than the set point, and is whitish and APL is larger than the set point At this time, the output of a comparator 48 serves as H level. the switch control circuit 44 Change-over switches 30r, 30g, and 30b and the movable piece of 36r, 36g, and 36b are connected to the 1stgamma amendment memory 32r and 32g and the individual terminal by the side of 32b, and the 1stgamma amendment memory 32r, 32g, and 32b is chosen as gamma amendment memory.
[0018] For this reason, the gamma correction property of the gamma correction circuit of a receiving side turns into a property which elongated the white level, as shown in (b) of drawing 2 . Namely, by the input signal voltage Bi corresponding to R of the analog video signals, G, and B signal becoming the same [a gamma correction property] as that of the conventional example in 0-Vm / 2 (the low range of a luminosity), as shown in the left-hand side of (d) of drawing 2 , although the proportionality of gamma= 1 is materialized, the overall characteristic after amendment As the input signal voltage Bi shows the right-hand side of (d) of drawing 2 in the range (range with a high luminosity) of Vm/2-Vm, rather than the case of the proportionality of gamma= 1 shown by the dotted line, the adjustable range of an output (permeability) becomes large, and a white level develops.
[0019] (c) Although it corresponds when the average luminance of the screen in 1 screen-display period is smaller than the set point, and is blackish and APL is smaller than the set point At this time, the output of a comparator 48 serves as L level. the switch control circuit 44 Change-over switches 30r, 30g, and 30b and the movable piece of 36r, 36g, and 36b are connected to the 2ndgamma amendment memory 34r and 34g and the individual terminal by the side of 34b, and the 2ndgamma amendment memory 34r, 34g, and 34b is chosen as gamma amendment memory.
[0020] For this reason, the gamma correction property of the gamma correction circuit of a receiving side turns into a property which elongated black level, as shown in (b) of drawing 3 . The input signal voltage Bi corresponding to R of the analog video signals, G, and B signal namely, in 0-Vm / 2 (the low range of brightness) As shown in the left-hand side of (d) of drawing 3 , rather than the case of the proportionality of gamma= 1 shown by the dotted line, the adjustable range of an output (permeability) becomes large, and black level develops. In the range (range with high brightness) of Vm/2-Vm, the input signal voltage Bi becomes the same [a gamma correction property] as that of the conventional example, as shown in the right-hand side of (d) of drawing 3 , and as for the overall characteristic after amendment, the proportionality of gamma= 1 is materialized.
[0021] Although formed in the aforementioned example by the 1stgamma amendment memory which memorized the gamma correction data for white-level extension for gamma amendment memory, and two kinds of gamma amendment memory of the 2ndgamma amendment memory which memorized the gamma correction data for black level extension this invention is not restricted to this and forms gamma amendment memory by three or more kinds of gamma amendment memory. each of such gamma amendment memory The gamma correction data which elongated the intensity level of the individual range to which it corresponds when classifying into the individual range of the number of memory kinds all the ranges of an intensity level that a video signal can take are memorized, and you may make it become.

[0022] Although a video signal is made into the input signal of the video signal which carried out the gamma correction to CRT displays beforehand by the transmitting side and gamma correction data were read from gamma amendment memory in the aforementioned example based on this received video signal, this invention cannot be restricted to this, can make an input signal the video signal which has not carried out a gamma correction by the transmitting side, and can use it also about what read gamma correction data from gamma amendment memory based on this received video signal.
[0023] although the aforementioned example explained the case where this invention was used for the gamma correction circuit of the liquid crystal display for color displays, this invention is not restricted to this and it can use also about the gamma correction circuit of the liquid crystal display for a monochrome display -- it is natural

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[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the outline block diagram showing one example of the gamma correction circuit of the liquid crystal display by this invention.
[Drawing 2] It is explanatory drawing which explains a gamma correction when APL is larger than the set point, and white-level extension in drawing 1 .
[Drawing 3] It is explanatory drawing which explains a gamma correction when APL is smaller than the set point, and black level extension in drawing 1 .
[Drawing 4] It is explanatory drawing explaining the gamma correction in the case of a CRT display.
[Drawing 5] It is the outline block diagram showing the gamma correction circuit of the liquid crystal light valve in the conventional example.
[Drawing 6] It is explanatory drawing explaining the gamma correction of drawing 5 .
[Description of Notations]
12r, 12g, 12b -- Input terminal 24r, 24g, 24b [-- The 2nd gamma correction memory for black level extension, 38 / -- Luminance-signal input terminal / 40 -- APL detector 42 / 48 -- Comparator 50 -- Selection means. / -- A judgment circuit 44 -- Switch control circuit] -- An output terminal, 32r, 32g, 32b -- The 1st gamma correction memory for white-level extension, 34r, 34g, 34b

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[Translation done.]

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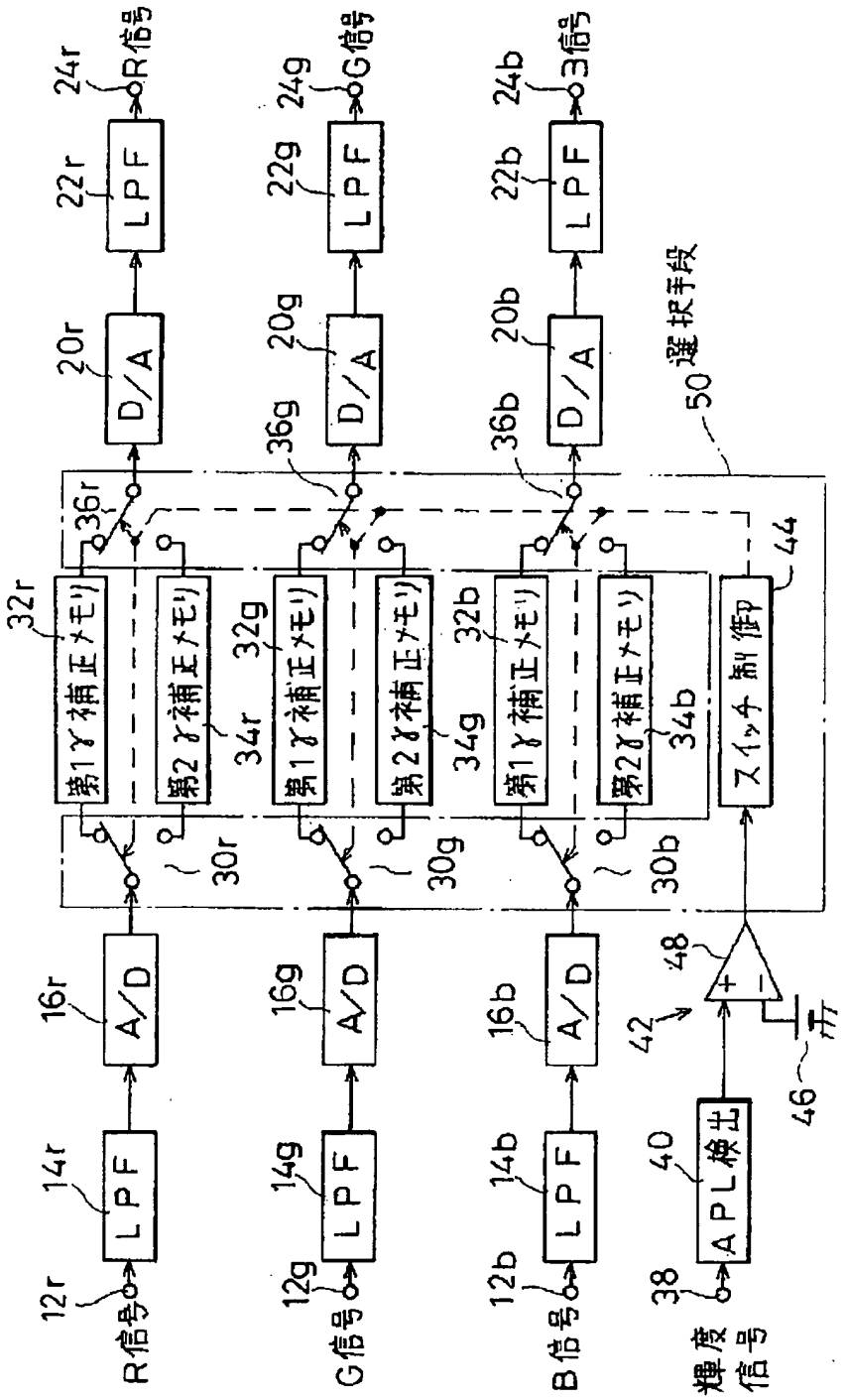
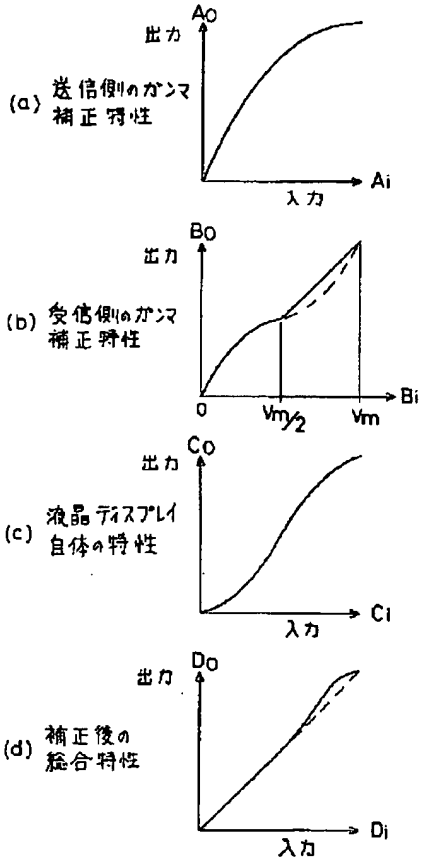
DRAWINGS

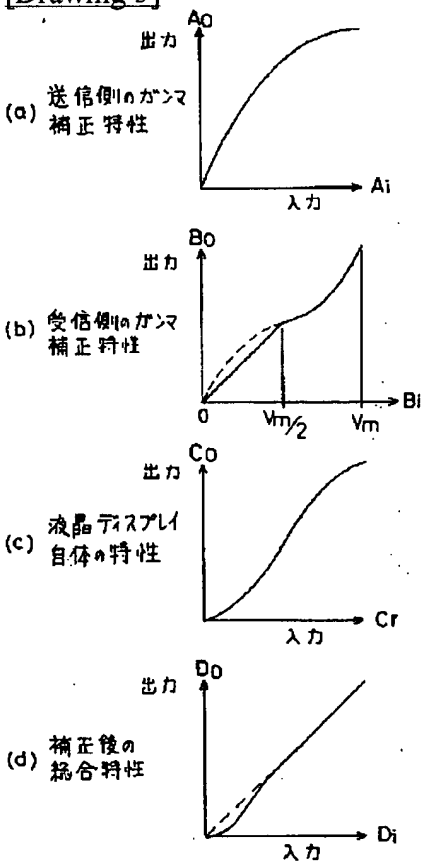
[Drawing 1]


R信号
G信号
B信号
輝度信号
LPF
A/D
APL検出
第1γ補正メモリ
第2γ補正メモリ
スイッチ制御
選択手段
D/A

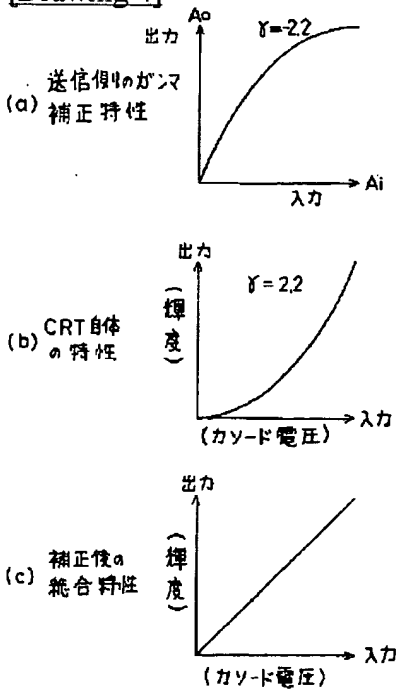
[Drawing 2]


(a) 送信側のガンマ補正特性
出力
Ao
入力
Ai
(b) 受信側のガンマ補正特性
出力
Bo
0
Vm/2
Vm
Bi
(c) 液晶ディスプレイ自体の特性
出力
Co
入力
Ci
(d) 補正後の総合特性
出力
Do
入力
Di

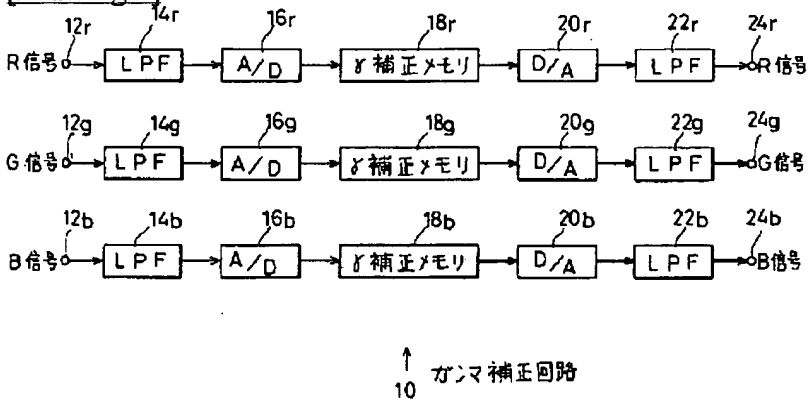
[Drawing 3]


(a) 送信側のガンマ補正特性
出力
Ao
入力
Ai
(b) 受信側のガンマ補正特性
出力
Bo
0
Vm/2
Vm
Bi
(c) 液晶ディスプレイ自体の特性
出力
Co
入力
Cr
(d) 補正後の総合特性
出力
Do
入力
Di

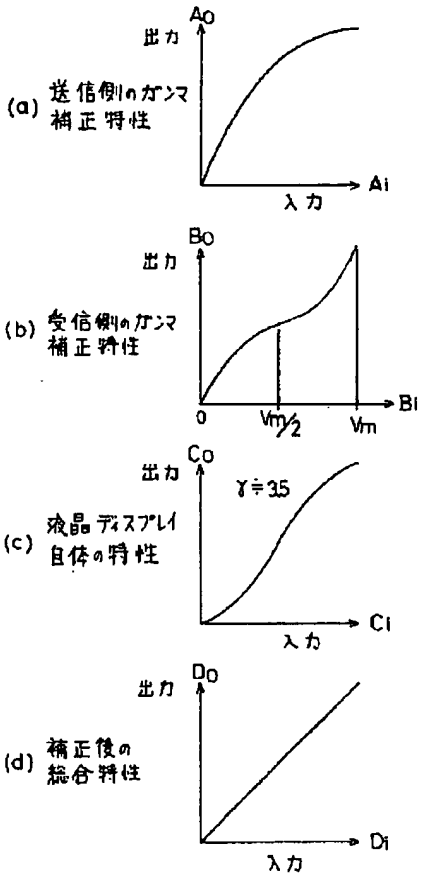
[Drawing 4]



[Drawing 5]



[Drawing 6]



[Translation done.]